

REMARKS

Claims 1-56 are pending in the application. Claims 24-26, 31-33, and 40 are amended. No new claims are added, and no claims are cancelled. In view of the following amendments and remarks, Applicant respectfully requests that this application be allowed and forwarded on to issuance.

Allowable Subject Matter

Claims 24-26, 31-33, and 40 have been objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant thanks that Examiner for the indication of allowable subject matter and has rewritten claims 24-26, 31-33, and 40 in independent form. These claims remain in condition for allowance.

Claims 43-49 have been allowed. Again, Applicant thanks the Examiner for the indication of allowable subject matter. Claims 43-49 remain unchanged.

The § 112 Rejections

Claims 23 and 34 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. In making out this rejection, the Office states that there is insufficient antecedent basis for the feature "wherein none of said polygons share a vertex."

Claim 23 depends from claim 16. Claim 16 recites "[i]n a computer graphic processing system in which a ray is cast toward an object represented by a

1 collection of pre-determined shapes, a method for determining which of the shapes
2 are intersected by the ray, the method comprising [emphasis added]:

- 3 • defining a collection of *polygons* that approximate an object,
4 individual polygons having a plurality of *vertices*;
- 5 • casting a ray toward the approximated object;
- 6 • defining a reference object relative to the collection of *polygons*
7 and that contains the cast ray;
- 8 • pre-characterizing at least some *vertices* of at least some of the
9 *polygons* to provide characteristic data that describes the
10 *vertices*' positions relative to the reference object; and
- 11 • using the characteristic data to ascertain the positions of the
12 individual *polygons* relative to the reference object."

13 Claim 23 recites "wherein none of said *polygons* share a *vertex*." Applicant
14 respectfully submits that there is antecedent basis for all terms within claim 23 and
15 therefore traverses the Office's rejection.

16 Claim 34 depends from claim 27. Claim 27 recites "[i]n a computer
17 graphic processing system in which a ray is cast toward an object represented by a
18 collection of pre-determined shapes, a method for determining which of the shapes
19 are intersected by the ray, the method comprising [emphasis added]:

- 20 • defining a plurality of *triangles* that approximate an object,
21 individual triangles having three *vertices*;
- 22 • casting a ray toward the approximated object;
- 23 • defining at least one plane relative to the approximated object to
24 contain the ray;
- 25 • pre-characterizing the *vertices* of the plurality of *triangles* to provide
characteristic data that describes the positions of the *vertices* relative
to said at least one plane; and
- using the characteristic data to ascertain the positions of the
individual *triangles* relative to said at least one plane."

1 **Claim 34** recites "wherein none of the *triangles* share any *vertices*."
2 Applicant respectfully submits that there is antecedent basis for all terms within
3 claim 34 and therefore traverses the Office's rejections.

4 In its § 112 rejections of claims 23 and 34, the Office further states that "the
5 claims languages are not following the specification languages." However, MPEP
6 § 2173.05(e) states [emphasis added]:

7 There is *no requirement* that the words in the claim must match
8 those used in the specification disclosure. Applicants are given a
9 great deal of latitude in how they choose to define their invention so
10 long as the terms and phrases used define the invention with a
11 reasonable degree of clarity and precision.

12 Applicant simply does not understand this rejection and has attempted to
13 address it in the previous response. It appears that the Office may be arguing that
14 since the term "polygon" is broader than the term "triangle", and since the
15 specification contains the statement "[o]ther collections can be defined where none
16 of the triangles share a vertex", that somehow a claim that recites that the
17 "polygons" do not share a vertex is somehow not supported by the specification or
18 is, in some way, unclear. Applicant respectfully directs the Office's attention to
19 page 10, lines 19-22 of the specification, which is reproduced below:

20 Other collections can be defined where none of the triangles share a
21 vertex. *Although triangles are depicted in the illustrated and described*
22 *embodiment, it is to be understood that other shapes or polygons can be*
23 *used to approximate an object.* (Emphasis added).

24 Based on this passage alone, it is abundantly clear that the example utilized
25 employs a polygon in the form of a triangle. Stated explicitly in the specification

1 is the statement that although triangles are depicted, other polygons can be used.
2 Applicant submits that there is nothing improper or unclear with respect to the
3 above-identified claims.

4 Applicant respectfully submits that the claimed subject matter has been
5 defined in such a clear and precise manner and is completely consistent with the
6 guidance provided by MPEP § 2173.05(e). Applicant therefore traverses the § 112
7 rejections.

8 Claims 41-42 stand rejected under §112, second paragraph. Claims 41 and
9 42 depend from claim 37, which is a method claim.

10 Claim 41 recites *one or more computer-readable media* having computer-
11 readable instructions thereon which, when executed by a computer, implement the
12 *method of claim 37*. Claim 42 recites *a programmable computer* having a
13 memory and a processor, the memory containing software code which causes the
14 processor to execute the *method of claim 37*.

15 In making out the rejection of these claims, the Office states:

16 Claims 41-42 recite the limitation "computer graphic
17 processing" and discloses in dependent claim 41 "one or more
18 computer-readable media" and in dependent claim 42
19 discloses "a programmable computer." There is insufficient
20 antecedent basis for this limitation in the claim. Applicant
21 should be able to clarify the following information:

22 1 - Is a "computer graphic processing system" just for
23 graphic processing and not for non-graphic processing?

24 2 - How many "one or more computer-readable media"
25 should be considered in this invention?

3- What does a "programmable computer" do that the others
"a computer graphic processing system" and "one or more
computer-readable media" cannot process?

1
2 Applicant does not understand the rejections of claims 41 and 42 or the
3 Office's questions. Applicant respectfully submits that there is antecedent basis
4 for all terms of claims 41 and 42. Applicant can find nothing inappropriate about
5 the recitations of these claims. As noted above, MPEP § 2173.05(e) states that
6 "[a]pplicants are given a great deal of latitude in how they choose to define their
7 invention so long as the terms and phrases used define the invention with a
8 reasonable degree of clarity and precision." Applicant respectfully submits that the
9 subject matter of these claims has been defined in such a clear and precise manner
10 and therefore respectfully traverses the rejections.

11 In the interest of furthering prosecution of this case, however, Applicant
12 will respectfully attempt to remedy any confusion the Office may have regarding
13 these claims by answering the Office's questions below:

14
15 1 - No, a computer graphic processing system is not necessarily *just* for
16 graphic processing. Such system can include a general purpose system which has
17 graphic processing capabilities.

18 2 - One or more computer-readable media could be a single computer-
19 readable medium or a plurality of computer-readable media. Additionally, there is
20 nothing inappropriate with respect to this terminology. For example, a search of
21 the PTO database of issued patents for the term "one or more computer readable
22 media" appearing in issued claims resulted in 57 hits including U.S. Patent Nos.
23 6,592,200; 6,585,350; 6,584,505.

24 3 - Preliminarily, Applicant does not understand the Office's question.
25 This notwithstanding, claims 37, 41, and 42 are directed to subject matter in

1 different statutory classes of subject matter as set forth in 35 U.S.C. §101.
2 Specifically, claim 37 is a *method* claim. This method takes place *in* a computer
3 graphic processing system as specified in the preamble. Claim 41 is directed to
4 one or more *computer-readable media* having instructions to *perform* the method
5 of claim 37. Examples of computer-readable media include RAM, ROM,
6 diskettes, CD-ROMs, etc as set forth in the specification and particularly with
7 respect to the discussion of Fig. 1. Although the method of claim 37 is
8 implemented by the instructions that reside on the computer-readable media, the
9 *computer-readable media* itself is what is claimed in claim 41. Claim 42 is
10 directed to a *programmable computer* having memory that contains software code
11 which causes a processor to execute the method of claim 37. While the
12 programmable computer may include one or more computer-readable media as
13 *components*, the programmable computer of claim 42 is recited to have a
14 *processor* that executes the method of claim 37 using the software code that is
15 contained in the recited memory. The *programmable computer* as a whole,
16 having the memory, the software code and the processor, is what is claimed in
17 claim 42.

18 Accordingly, Applicant respectfully submits that these claims are in proper
19 format and are allowable as indicated above.

21 The §§ 102 and 103 Claim Rejections

22 Claims 1-9, 12-14, 16-20, 27-30, 35, 37, 50-54 and 56 stand rejected under
23 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,226,005 to
24 Laferriere.

1 Claims 10-11, 15, 36, 38-39 and 55 stand rejected under 35 U.S.C. § 103(a)
2 as being unpatentable over Laferriere in view of U.S. Patent No. 6,111,582 to
3 Jenkins.

4
5 **Claims 1-15**

6 **Claim 1** recites a method for determining which shapes are intersected by a
7 ray in a computer graphic processing system in which a ray is cast toward an
8 object represented by a collection of pre-determined shapes each characterized by
9 characteristic data. Accordingly, the method recites:

- 10
- 11 • defining a reference object relative to the represented object;
 - 12 • determining the positions of the shapes relative to the reference
13 object using the characteristic data; and
 - 14 • *determining*, on the basis of the positions of the shapes relative to
15 the reference object, those shapes that have *no chance of
intersecting the ray*, and those remaining shapes that *may intersect
the ray*.

16 The Office argues that the subject matter of this claim is anticipated by
17 Laferriere. Applicant is unclear as to what the Office considers to be equivalent to
18 Applicant's reference object; but, even assuming *for argument's sake only* that
19 Laferriere does disclose a reference object as Applicant uses the term, Laferriere
20 does not disclose the recited act of "determining, on the basis of the positions of
21 the shapes relative to the reference object, those shapes that have *no chance of
intersecting the ray*, and those remaining shapes that *may intersect the ray*." The
22 Office argues that this feature is disclosed by Laferriere in Figs. 5a-5m. Applicant
23 respectfully but strongly disagrees.
24
25

1 Figs. 5a-5m of Laferriere disclose possible categories of intersection
2 between a triangular polygon and a *square texture pixel*. It appears that
3 Laferriere's methods as described in connection with these specific figures do not
4 pertain to ray tracing at all. There is no disclosure or even a suggestion that
5 Laferriere utilizes a method for "determining, on the basis of the positions of the
6 shapes relative to the reference object, those shapes that have *no chance of*
7 *intersecting the ray*, and those remaining shapes that *may intersect the ray*."
8 Accordingly, for at least this reason, claim 1 is allowable.

9 Claims 2-15 depend from claim 1 and are allowable as depending from an
10 allowable base claim. These claims are also allowable for their own recited
11 features which, in combination with those recited in claim 1, are neither disclosed
12 nor suggested in the references of record, either singly or in combination with one
13 another. In addition, given the allowability of these claims, Jenkins is not seen to
14 add anything of significance to the rejection of claims 10, 11, and 15.

15 Claims 16-23

16 Claim 16 recites a method for determining which of a collection of pre-
17 determined shapes are intersected by a ray cast toward an object that is represented
18 by the shapes. The method recites:
19

- 20 • defining a collection of polygons that approximate an object,
21 individual polygons having a plurality of vertices;
- 22 • casting a ray toward the approximated object;
- 23 • defining a reference object relative to the collection of polygons and
24 that *contains the cast ray*;
- 25 • pre-characterizing at least some vertices of at least some of the
polygons to provide characteristic data that describes the vertices'
positions relative to the reference object; and

- using the characteristic data to ascertain the positions of the individual polygons relative to the reference object.

In making out the rejection of this claim, the Office apparently argues that the recited act of "defining a reference object relative to the collection of polygons and that *contains the cast ray*" is disclosed by Laferriere in column 3, lines 18-21.

That excerpt is set forth below:

(iii) for each determined area of intersection [between the polygon and a square texture pixel], determining the product of illumination information at said determined location of intersection and the weight of said area of intersection

There is not even any *mention* of a ray within the excerpt cited by the Office. Therefore, there appears to be no disclosure or even suggestion that Laferriere defines "a reference object relative to the collection of polygons and that *contains the cast ray*", as that term is used in the claim. Accordingly, for at least this reason, claim 16 is allowable.

Claims 17-23 depend from claim 16 and are allowable as depending from an allowable base claim. These claims are also allowable for their own recited features which, in combination with those recited in claim 16, are neither disclosed nor suggested by the references of record, either singly or in combination with one another.

Claims 27-30 and 34-36

Claim 27 recites a method for determining which of a number of shapes that represent an object are intersected by a ray that is cast toward the object. The method recites:

- defining a plurality of triangles that approximate an object, individual triangles having three vertices;
- casting a ray toward the approximated object;
- defining at least *one plane* relative to the approximated object *to contain the ray*;
- pre-characterizing the vertices of the plurality of triangles to provide characteristic data that describes the positions of the vertices relative to said at least one plane; and
- using the characteristic data to ascertain the positions of the individual triangles relative to said at least one plane.

In making out the rejection of this claim, the Office apparently argues that the recited act of “defining at least *one plane* relative to the approximated object *to contain the ray*” is disclosed by Laferriere in column 3, lines 18-21. That excerpt is set forth below:

(iii) for each determined area of intersection [between the polygon and a square texture pixel], determining the product of illumination information at said determined location of intersection and the weight of said area of intersection

Again, there is no *mention* of a ray within this excerpt. Therefore, there appears to be no disclosure or even suggestion that Laferriere defines “at least *one plane* relative to the approximated object *to contain the ray*.” Accordingly, for at least this reason, claim 27 is allowable.

Claims 28-30 and 34-36 depend from claim 27 and are allowable as depending from an allowable base claim. These claims are also allowable for their own recited features which, in combination with those recited in claim 27, are neither disclosed nor suggested by the references of record, either singly or in combination with one another. Additionally, given the allowability of claim 36,

1 the rejection over the combination of Laferriere and Jenkins is not seen to add
2 anything of significance.

3
4 **Claims 37-39 and 41-42**

5 **Claim 37** recites a method for determining which of a number of polygons
6 that represent an object are intersected by a ray that is cast at the object. The
7 method recites:

- 8
- 9 • defining a sub-set of polygons from a collection of polygons that
10 approximate an object by determining which polygons have vertices
11 that satisfy a predefined relationship relative to a reference object;
12 and
 - 13 • evaluating the sub-set of polygons to ascertain which of the
14 polygons is intersected by a *cast ray*.

15 In making out the rejection of this claim, the Office apparently argues that
16 the recited act of "evaluating the sub-set of polygons to ascertain which of the
17 polygons is intersected by a *cast ray*" is disclosed by Laferriere in column 3, lines
18 18-21. That excerpt discloses determining the intersection between a triangular
19 polygon and a *square texture pixel*. A cast ray is not even disclosed within the
20 excerpt. Therefore, there appears to be no disclosure or even suggestion that
21 Laferriere evaluates a sub-set of polygons to ascertain which of the polygons is
22 intersected by a *cast ray*." Accordingly, for at least this reason, claim 37 is
23 allowable.

24 **Claims 38-39 and 41-42** depend from claim 37 and are allowable as
25 depending from an allowable base claim. These claims are also allowable for their

own recited features which, in combination with those recited in claim 37, are neither disclosed nor suggested by the references of record, either singly or in combination with one another.

Claims 50-56

Claim 50 recites a computer graphic processing system comprising:

- a processor;
- memory; and
- software code stored in the memory that causes the processor to implement a ray-intersection algorithm which:
 - casts a ray at a collection of shapes that approximate an object;
 - *defines a reference object that contains the ray*;
 - pre-characterizes aspects of individual ones of the shapes of the collection to provide characteristic data; and
 - uses the characteristic data to ascertain the position of the shapes of the collection of shapes relative to the reference object.

In making out the rejection of this claim, the Office apparently argues that the recited act that “defines a reference object that *contains the ray*” is disclosed by Laferriere in column 3, lines 18-21.

However, there appears to be no disclosure or even suggestion that Laferriere “defines a reference object that *contains the ray*.” In part, this is because Laferriere makes no mention of any ray whatsoever within the excerpt cited by the Office. Accordingly, for at least this reason, claim 50 is allowable.

Claims 51-56 depend from claim 50 and are allowable as depending from an allowable base claim. These claims are also allowable for their own recited features which, in combination with those recited in claim 50, are neither disclosed

1 nor suggested by the references of record, either singly or in combination with one
2 another. In addition, given the allowability of these claims, the rejection of claim
3 55 over the combination with Jenkins is not seen to add anything of significance.
4

5 **Conclusion**

6 Applicant has studied the references cited by the Office and has sincerely
7 attempted to describe how the claimed subject matter patentably distinguishes over
8 these references. Applicant submits that all of the claims are in condition for
9 allowance and respectfully requests that the Office withdraw the finality of the
10 present office action and pass the application along to issuance. If the Office's
11 next anticipated action is to be anything other than issuance of a Notice of
12 Allowability, Applicant respectfully requests a telephone call for the purpose of
13 scheduling an interview.
14

15 Respectfully Submitted,

16 Dated: 9/22/03

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